

## CLAIMS

We claim:

1. A method for reducing noise from laser amplitude fluctuations in a desired signal generated by a multi-line laser comprising:
  - 5 matching the spectral dependence of a monitor of amplitude fluctuations of a multi-line laser source to the spectral dependence of a desired signal, forming a matched monitor signal;
  - subtracting the matched monitor signal from the desired signal.
- 10 2. The method of claim 1, further comprising applying a Rayleigh correction to the multi-line laser output or the desired signal.
3. The method of claim 2, wherein applying the Rayleigh correction comprises passing one or both of the desired signal or output of the multi-line laser through a  
15 Rayleigh optic.
4. The method of claim 1, wherein the desired signal is a scattered light signal.
5. A method for reducing noise from laser amplitude fluctuations in a desired signal  
20 generated by a multi-line laser comprising:
  - passing a portion of the output of a multi-line laser through a spectrally flat optic, forming a laser monitor signal;
  - monitoring the desired signal;
  - adjusting the intensity of the laser monitor signal so that laser amplitude fluctuations in  
25 the desired signal and the laser monitor signal are equal, forming a corrected signal;
  - subtracting the corrected signal from the desired signal.
6. The method of claim 5, wherein the desired signal is a scattered light signal.
- 30 7. The method of claim 5, further comprising applying a Rayleigh correction to the multi-line laser output or the desired signal.

8. The method of claim 7, wherein applying the Rayleigh correction comprises passing either the multi-line laser output or the desired signal through a Rayleigh optic.

5 9. A method for reducing noise from laser amplitude fluctuations in a desired signal generated by a multi-line laser, comprising:  
passing a portion of the output of the multi-line laser through an output coupler, forming a laser output signal;  
passing the laser output signal through a compensating optic, forming a laser monitor signal, wherein the spectral dependence of the laser monitor signal matches that of the  
10 desired signal;  
subtracting the laser monitor signal from the desired signal.

10. The method of claim 9, further comprising applying a Rayleigh correction to the output of the multi-line laser or the desired signal.

15 11. The method of claim 10, wherein applying the Rayleigh correction comprises passing either the output of the multi-line laser or the desired signal through a Rayleigh optic.

20 12. The method of claim 9, further comprising adjusting the intensity of the laser monitor signal so that laser amplitude fluctuations in the desired signal and the laser monitor signal are equal, forming a corrected signal; subtracting the corrected signal from the desired signal.

25 13. The method of claim 9, wherein the desired signal is a scattered light signal.

14. A laser scattering system having reduced noise comprising:  
a laser cavity having output along a laser beam axis;  
an output coupler coupled to one end of the laser cavity along the laser beam axis;  
30 an optional compensating optic in optical communication with the output coupler;  
an output detector in optical communication with the compensating optic;  
a gain adjusting element in electrical communication with the output detector;

a scattered light detector at a selected angle away from the laser beam axis;  
a differencing junction in electrical communication with the gain adjusting element and  
in electrical communication with the scattered light detector.

5 15. The system of claim 14, wherein the output coupler is spectrally flat.

16. The system of claim 14, further comprising one or more Rayleigh optics.

10 17. A method of actively reducing laser amplitude fluctuation noise from a desired  
signal comprising:

passing a portion of the output of the multi-line laser through a spectrally flat output  
coupler, forming a laser monitor signal;

comparing a desired laser output setpoint to the intensity of the laser monitor signal;

15 adjusting the laser output so that the intensity of the laser monitor signal is the same as  
the desired laser output setpoint;

whereby the laser amplitude fluctuation noise in the desired signal is reduced.

18. The method of claim 17, wherein the desired signal is a scattered light signal.

20 19. A method of automated laser amplitude noise reduction from a desired signal  
comprising:

passing a portion of the output of the multi-line laser through a spectrally flat output  
coupler, forming a laser monitor signal;

monitoring the scattered light signal;

25 adjusting the intensity of the laser monitor signal so that fluctuations in the desired signal  
and the laser monitor signal are equal, forming a corrected signal;

subtracting the corrected signal from the desired signal;

automatically adjusting the intensity of the laser monitor signal so fluctuations in the  
desired signal and the laser monitor signal are equal, forming a corrected signal;

30 subtracting the corrected signal from the desired signal.

20. The method of claim 19, wherein the desired signal is a scattered light signal.